

### Remarks

This responds to the Office Action mailed on January 3, 2008.

Claims 23 and 25 have been amended, no claims have been canceled, or added. Claims 1-5, 7-23, 25-31, 36-64, 66-67, and 69-71 are pending in the present application, of which claims 1-5, 7-22, 43-46, 50-64, and 66-67 were withdrawn from consideration. As a result, this response addresses the rejection of claims 23, 25-31, 36-42, 47-49, and 69-71 in the Non-Final Office Action dated January 3, 2008.

Claims 23 and 25 have been amended to recite a “cross-linked metal oxide or silicon oxide based sol-gel material comprising organic cross-links connecting the surface active groups of the metal oxide or silicon oxide based sol-gel material.” This amendment is supported, for example, at page 10, line 30 to page 11, line 4 of the present specification.

### The 35 U.S.C. §102 Rejections

Claims 23, 25-31, 36-42, 47-49, and 69-71 were rejected under 35 U.S.C. §102(b) as being anticipated by Novak et al. (Chem. Mater., 6, 282-286 (1994)). Claims 23 and 25 have been amended. However, to the extent the rejection applies to claims 23, 25-31, 36-42, 47-49, and 69-71, Applicants respectfully traverse the rejection.

“[F]or anticipation under 35 U.S.C. §102, the reference must teach *every aspect* of the claimed invention either explicitly or impliedly.” M.P.E.P. §706.02 (emphasis added).

Applicants respectfully submit that claims 23, 25-31, 36-42, 47-49, and 69-71 are not anticipated by Novak et al. because such document does not teach each and every aspect of the claimed invention. While Applicants believe that the previously submitted arguments in the Amendment and Response of October 30, 2007, (which is incorporated herein by reference) are sufficient to overcome the rejection, the following additional remarks are presented herein in an effort advance prosecution of the pending claims.

Novak et al. disclose two methods of forming low-density, mutually interpenetrating organic-inorganic composite materials.

In the first method, Novak et al. disclose the independent formation of the organic polymer before the formation of the sol-gel material. For example, Novak et al. disclose one method in which the preformed polymer, TMOS, and water are mixed with the appropriate

amount of cosolvent and the pH adjusted to form a gel (*see, e.g.,* page 283, left column, paragraph 2, lines 12-15). This gel forms an interpenetrating network of organic polymer and aerogel after further processing. In this material, Novak et al. disclose that PVP shows little if any leaching from the gels, presumably, due to extensive hydrogen-bonding interactions between pyridine acceptors and the free silanols of the inorganic network (*see, e.g.,* page 283, right column, lines 5-9). Novak et al. further disclose that the mechanical properties of the PVP polymer composites could be further improved by incorporating small amount of  $\text{CuCl}_2$  to crosslink the PVP by binding to multiple pyridinyl moieties on different polymer chains (*see, e.g.,* page 283, right column, lines 9-13). In short, this method forms an **inorganic** crosslinker (i.e.,  $\text{CuCl}_2$ ) to crosslink the **organic polymer** that is present in the polymer/aerogel interpenetrating network.

In the second method as shown in Scheme 1, Novak et al. disclose that:

[a]lternating, the polymers can be synthesized in situ by simultaneously carrying out the sol-gel condensation reaction and an independent free-radical polymerization of an appropriate vinyl monomer. This latter approach is particularly important because it allow the incorporation of crosslinks within the organic polymer to form two truly interpenetrating networks.

(*e.g.,* page 283, right column, paragraph 3, lines 1-7).

However, Applicants respectfully submit that Novak et al. do not disclose a “cross-linked metal oxide or silicon oxide based sol-gel material comprising **organic cross-links** connecting the **surface active groups** of the **metal oxide** or **silicon oxide** based sol-gel material” (*e.g.,* claims 23 and 25, emphasis added). On the contrary, Novak et al. disclose that they were unsuccessful using **organic crosslinking agents**, for example, common divinyl comonomers, to crosslink the PVP organic polymer (*see, e.g.,* page 285, left column, lines 18-23).

Applicants also respectfully submit that Novak et al. is completely silent regarding the formation of **organic cross-links** connecting the **surface active groups** of the **metal oxide** or **silicon oxide** based sol-gel material. Further, Applicants respectfully submit that Novak et al. do not disclose the use of silica as one of the two reagents in the polymerization process nor suggest the formation of any polyurethane. In evaluating lack of disclosure regarding an obviousness rejection, the Court of Customs and Patent Appeals has stated that “[s]ilence in a reference is hardly a proper substitute for an adequate disclosure of facts from which a conclusion of

obviousness may justifiably follow” (e.g., *In re Burt and Walter*, 148 U.S.P.Q. 548, 553 (C.C.P.A. 1966)). If silence regarding a particular claim element is insufficient to support an obviousness rejection, it logically must be insufficient to support an anticipation rejection.

As such, Applicants respectfully submit that claims 23, 25-31, 36-42, 47-49, and 69-71 are not anticipated by Novak et al. Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §102(b).

Claims 23, 25-31, 36-42, 47-49, and 69-71 were rejected under 35 U.S.C. §102(e) as being anticipated by Yim et al. (*Korean J. Chem. Eng.*, 19(1), 159-166 (2002)). Claims 23 and 25 have been amended. However, to the extent the rejection applies to claims 23, 25-31, 36-42, 47-49, and 69-71, Applicants respectfully traverse the rejection.

Applicants respectfully submit that Yim et al. is not a proper reference under 35 U.S.C. §102(e) because Yim et al. is not “(1) ***an application for patent***, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) ***a patent*** granted on an application for patent by another filed in the United States before the invention by the applicant for patent” (e.g., 35 U.S.C. §102, emphasis added).

As such, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §102(e).

Assuming *arguendo*, however, that the Examiner intended to reject claims 23, 25-31, 36-42, 47-49, and 69-71 under 35 U.S.C. §102(a) as being anticipated by Yim et al. (*Korean J. Chem. Eng.*, 19(1), 159-166 (2002)), the Applicants respectfully traverse the rejection.

While Applicants believe that the previously submitted arguments in the Amendment and Response of October 30, 2007, (which is incorporated herein by reference) are sufficient to overcome the rejection, the following additional remarks are presented herein in an effort advance prosecution of the pending claims.

The Examiner alleged that Applicants have not established the differences discussed in their reply to be associated with differences in the products claimed (*see*, e.g., page 3, Non-Final Office Action mailed January 3, 2008). Applicants respectfully disagree.

Applicants respectfully submit that the aerogels of Yim et al. are fundamentally different from the claimed materials. For example, Yim et al. disclose that the silanols formed in the

*partially* condensed silica solution react with the di-isocyanate yielding carbamates in a reaction that takes a couple of weeks (*see, e.g.,* paragraph 2, page 160, left column and Equation 2, page 161, left column). In contrast, the claimed materials are prepared by letting the silica precursors react and gel within minutes to form a preformed silica skeletal framework containing surface silanols, which are subsequently reacted with a crosslinker. Applicants respectfully submit that the aerogels of Yim et al. are very brittle as compared to the claimed materials. For example, the present specification discloses that:

Direct mixing of a diisocyanate and an alcohol-free sol has been attempted recently by Yim et al., Korean J. Chem. Eng., 19:159-166 (2002) and Mizushima and Hori, J. Non-Cryst. Solids, 170:215-222 (1994). Reportedly, these procedures lead to week-long gelation times and require an at least equally long aging period. In the attempt to add various amounts of di-ISO in a base-catalyzed sol in PC, a week-long gelation time was noticed. The resulting aerogels were translucent but *no less brittle* than native silica.

(*e.g.,* page 18, lines 3-8 of the present specification, *emphasis added*). In other words, there was no increase in the mechanical properties of the aerogels of Yim et al. compared with the aerogels prepared from native silica. In contrast, the claimed materials exhibit a dramatic improvement in strength relative the native silica aerogels. For example, the present specification discloses that:

[t]he most dramatic improvement yet is in the strength of the new material (Table 11), as tested with a three-point flexural bending method. It takes *more than 100 times higher load* to break a monolith with density  $0.447 \text{ g cm}^{-3}$  (about 15 kg) than to break a *native silica aerogel* monolith (about 120 g).

(*e.g.,* page 15, lines 3-6 of the present specification, *emphasis added*). As such, Applicants respectfully submit that the claimed materials are much more flexible than the materials disclosed by Yim et al.

As such, Applicants respectfully submit that claims 23, 25-31, 36-42, 47-49, and 69-71 are not anticipated by Yim et al. Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §102(a).

Conclusion

Applicants respectfully submit that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney at (612) 373-6905 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 28 day of March 2008.

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